

## The Anophthalmic *Trechiana* (Coleoptera, Trechinae) from the Nunobiki Hills and their Surrounding Areas<sup>1)</sup>

By

Shun-Ichi UÉNO\*

上野 俊一\*: 布引山地とその周辺地域のナガチビゴミムシ属甲虫類

The Nunobiki Hills are a kind of low plateau stretching for about 40 km in a north-south direction at the southern part of northeastern Honshu, Japan. The area is limited by the alluvium of the Abukuma-gawa River on the east, by its tributary Gohyaku-gawa on the north and by the Oh-kawa Valley on the west. It is lower in the north (around 1,000 m in height) than in the south (1,500 m or more in height), and continues southwards to the Nasu Volcanoes. Because of this rather monotonous topography, the Nunobiki Hills have not attracted attention of Japanese entomologists and have escaped from close investigation of the fauna.

Having described *Trechiana sonuta* (UÉNO, 1992 b, p. 28, figs. 4-6) from the central part of the Abukuma Hills, however, I came to realize the zoogeographical importance of the Nunobiki Hills, which intervene between the known locality of the new species and that of its closest relative, *T. balli*. Repeated collectings were attempted after that to clarify the trechine fauna of the hilly area, and soon in August of the next year, an anophthalmic trechine beetle was found out by OHKAWA and ONDA at its southern part. It turned out to be a species belonging to a different subgroup (cf. UÉNO, 1993, p. 2), but two months later, a new species indubitably belonging to the *balli-sonuta* complex was discovered at the central part, which amply proved my supposition to be correct. Since then, we have surveyed almost all parts of the Nunobikis, and have succeeded in collecting anophthalmic trechines at eight stations. It has been clarified that the northeastern and central parts of the hilly area are inhabited by a member of the *echigonis* subgroup, but that a species of the *insperatus* subgroup extends its distribution towards the north along the western side of the Nunobikis to its northern end. It has also been clarified that other new species of the former lineage occur in the adjacent areas north and northwest of the Nunobiki Hills, but that the Minamiaizu Hills west of the Oh-kawa Valley are occupied at least by a species of the latter lineage. Strangely enough, no other anophthalmic trechines than the members of *Trechiana* have so far been met with on the Nunobikis, although *Trechiana sonuta* coexists with *Kurasawatrechus zenbai* S. UÉNO (1990 b, p. 176, figs. 1-2) at the central part of the Abukuma Hills (No. 12 in Fig. 23) and *T. insperatus* coexists with a *Kurasawatrechus* at the northeastern part of the Minamiaizu Hills (No. 23 in Fig. 23).

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\* Department of Zoology, National Science Museum, Tokyo.

国立科学博物館 動物研究部

In the present paper, I am going to describe four new species of the *echigonis* lineage of *Trechiamma* and to record new localities of *T. insperatus*. Phylogenetic relationship and radiation of the members of the *echigonis* subgroup will be discussed, and the known localities of the trechine beetles belonging to the two subgroups will be shown on a sketch map. The abbreviations employed herein are the same as those explained in previous papers of mine.

Before going into further details, I wish to express my deep indebtedness to Dr. Yoshiaki NISHIKAWA and Mr. Shinzaburo SONE, who always helped me in the field works, and to Messrs. Hideo OHKAWA and Kengo ONDA, who promptly submitted their findings to me for taxonomic study. But for their kind support, the present study could never have been completed.

### Descriptions of New Species

#### *Trechiamma* (s. str.) *planipennis* S. UÉNO, sp. nov.

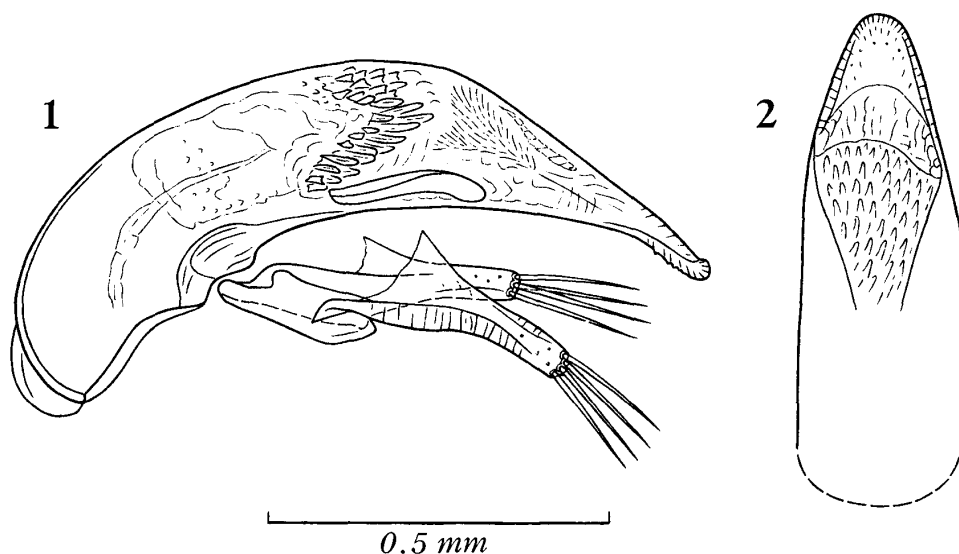
(Figs. 1-2, 10)

Length: 4.70–4.95 mm (from apical margin of clypeus to apices of elytra).

Closely similar in external morphology to *T. echigonis* S. UÉNO (1972, p. 43, figs. 1–3; 1985, p. 74) from Harukiyama of the Kushigata Hills, but the body is obviously flatter with stouter appendages. Closer to *T. accipitris* S. UÉNO (1983, p. 8, figs. 2–5; 1985, p. 74, pl. 14, fig. 15) of the Shirataka Hills in male genitalic features, but readily distinguished from it by the flattened body, the posteriorly lying proximal dorsal pore on the elytra, and the differently shaped copulatory piece, the last one of which resembles that of *T. echigonis*.

Colour as in *T. echigonis*.

Head large, widely depressed on dorsum, with frontal furrows deeply impressed in front and forming on each side a relatively steep declivity of the anterior part of the inner side of supraorbital area; genae feebly convex, more gradually narrowed behind than in *T. echigonis*; neck constriction shallow, less sharply marked than in *T. echigonis*; labrum slightly emarginate at apex instead of being



Figs. 1-2. Male genitalia of *Trechiamma* (s. str.) *planipennis* S. UÉNO, sp. nov., from the Gokuraku-tôgê; left lateral view (1), and apical part of aedeagus, dorso-apical view (2).

straight; mentum tooth broad especially at the base and slightly bifid at the tip; antennae stouter than in *T. echigonis*, reaching basal four-ninths of elytra, with segments 7–9 each about 2.5 times as long as wide; other cephalic features as in *T. echigonis*.

Pronotum more widely depressed on the disc than in *T. echigonis*, widest at two-thirds from base, with the basal area less dilated posteriad; sides more strongly and regularly arcuate in front, rather shallowly sinuate at basal fifth, and then either very slightly divergent towards hind angles or subparallel; hind angles sharp and usually a little more produced posteriad than laterad, rarely rectangular; base only slightly wider than apex, nearly straight at middle but slightly oblique posteriad on each side; front angles obtuse and hardly produced, obviously less marked than in *T. echigonis*; PW/HW 1.38–1.41 (M 1.40), PW/PL 1.17–1.19 (M 1.18), PW/PA 1.45–1.49 (M 1.47), PW/PB 1.32–1.41 (M 1.37), PB/PA 1.03–1.13 (M 1.08) [PA/PB 0.89–0.97 (M 0.93)]; other pronotal features as in *T. echigonis*.

Elytra evidently flatter than in *T. echigonis*, widely depressed on the disc and with gentle apical and lateral declivities, ovate, widest at a level between basal two-fifths and four-ninths, and more gradually narrowed towards apices than towards bases; EW/PW 1.62–1.68 (M 1.65), EL/EW 1.46–1.50 (M 1.49); shoulders less distinct and more widely rounded than in *T. echigonis*, with prehumeral borders more oblique; sides not so widely reflexed before middle as in *T. echigonis*, regularly arcuate in proximal two-thirds, very feebly so behind, and rather narrowly rounded at apices, which usually form a small re-entrant angle at suture; striation and chaetotaxy as in *T. echigonis*, though the proximal dorsal pore on the 5th stria is located at a level between basal 1/4 and 2/5 (usually 2/7), or much more distant from base instead of being located slightly before the level of the fourth umbilicate pore of the marginal series.

Legs obviously stouter than those in *T. echigonis*, though basically identical in conformation with the latter.

Male genital organ generally similar to that of *T. accipitris*, though markedly different in configuration of copulatory piece. Aedeagus one-third as long as elytra, more regularly arcuate from base to apex than in *T. accipitris*, with the basal part hardly bent, though gently curved, towards the ventral side; apical lobe shorter than in *T. accipitris*, with the apex simply rounded in dorsal view instead of being subtruncated; ventral margin shallowly emarginate in profile. Inner sac armed with a copulatory piece, two patches of sclerotized teeth, and a patch of thin spine-like scales; copulatory piece about two-ninths as long as aedeagus, somewhat spatulate, curved ventrad in apical part, rounded at the apex, and lying at a right ventral position; left proximal teeth-patch consisting of large, heavily sclerotized teeth lying above the left side of copulatory piece, and somewhat sigmoidally curved at the dorsal part; dorso-apical teeth-patch horizontal, lying just inside apical orifice; patch of thin scales fairly large, subtriangular as a whole, and situated behind left proximal teeth-patch. Styles fairly slender, left style obviously longer than the right, each bearing four setae at the apex.

*Type specimen.* Holotype: ♂, allotype: ♀, 24–VIII–1995, S. SONE & Y. NISHIKAWA leg. Paratypes: 1 ♀, 22–VIII–1994, Y. NISHIKAWA leg.; 1 ♂, 24–VIII–1995, S. SONE & Y. NISHIKAWA leg. All deposited in the collection of the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo.

*Type locality.* Gokuraku-tôgê, 330 m in altitude at the northwestern side, near Kogura of Oguni-machi in Yamagata Prefecture, northeastern Honshu, Northeast Japan.

*Notes.* This is an interesting species combining characters from *T. echigonis* and *T. accipitris*. It

is probably closer to the former because of the similarity in external features and in configuration of copulatory piece, but the general configuration of its male genitalia is very similar to that in the latter. Geographically, its type locality lies between those of the two species, but is much nearer to that of the former (cf. Fig. 23, Nos. 1, 2 and 3).

The above description of *T. planipennis* was originally prepared on a single female collected in the summer of 1994. It seemed to me preferable to name it in the present paper even on a female specimen alone, since its occurrence fills in the wide geographical gap between the locality of *T. echigonis* and those of the other members of the same species-complex. As three additional specimens were obtained at the last moment, however, I hastily rewrote the original account, added a description of male genitalic characters to that of the external morphology, and replaced the earlier manuscript with the present one.

The type locality of *T. planipennis* is a small scree deposited at the right side of a narrow stream flowing into the Ohtaki-gawa, a tributary of the Ara-kawa River. Thus, it lies in the same drainage system as that of *T. echigonis*, which is 27.5 km distant to the west-northwest from the former. It is nearer to the type locality of *T. balli* S. UÉNO (1986 b, p. 15, figs. 1–3), which is 20 km distant to the southeast from the former and lies in the Mogami-gawa drainage area. Flowing on a low gentle hill only 400 m high, the streams that empty into the Ohtaki-gawa have usually deposited very sticky clay on their banks, which is not favourable for harbouring upper hypogean beetles. Only the exception we have found out in that area is the small scree, only 5 m wide, 1.5 m deep and 30–50 cm in thickness. In spite of four visits to this place, we were unable to collect any additional specimen, and as the last resort, we dug it up to the bedrock on July 16, 1995, and after setting wet rice-straw mats at the bottom, put back the soil and rock debris as much as we could. This attempt brought about a good result; three specimens of the trechine beetle, including two males, were finally caught by SONE and NISHIKAWA on August 24, about a month and a half after the setting of the trap, all attracted to the wet mats.

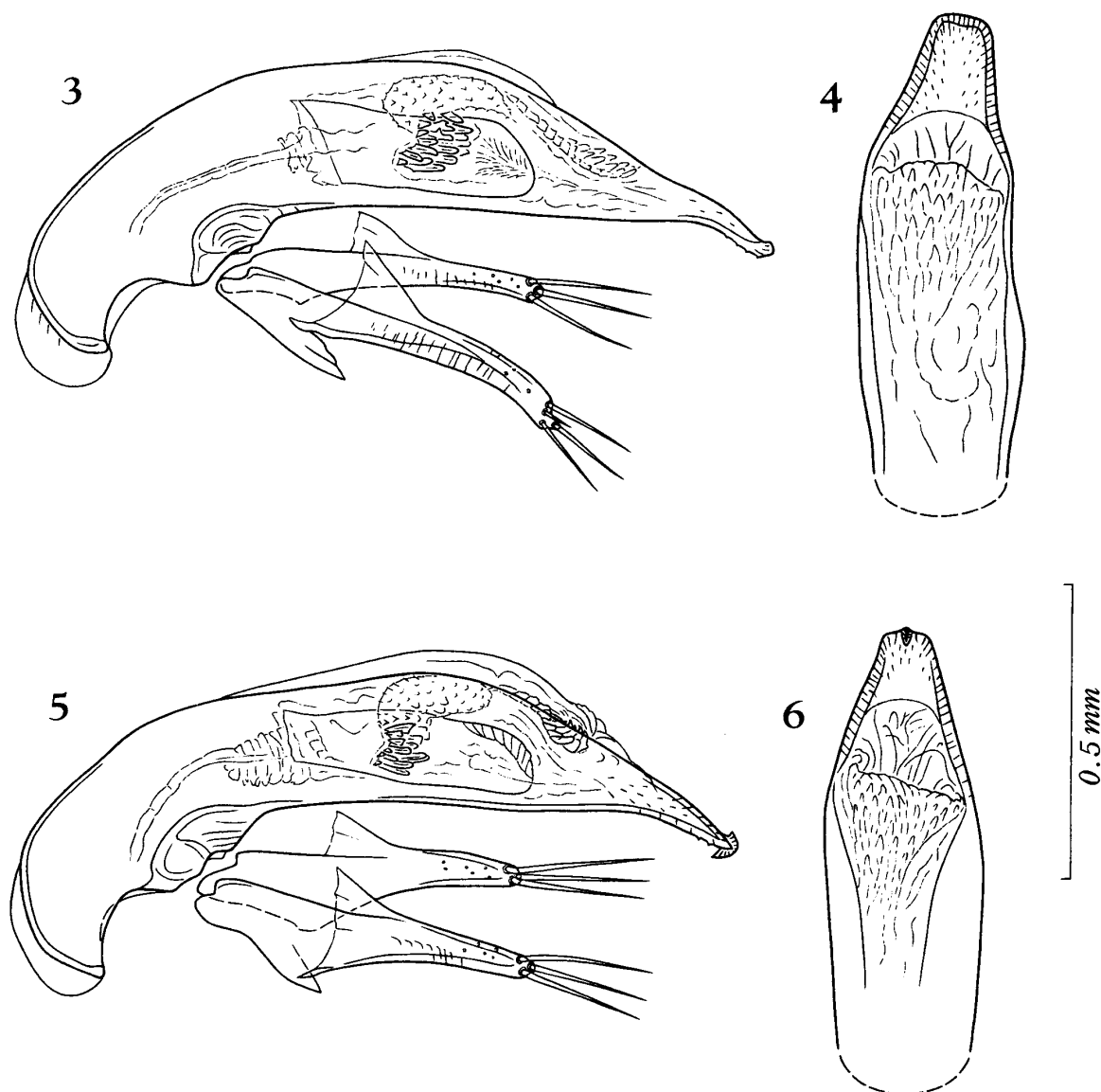
*Trechiamia* (s. str.) *sinuatus* S. UÉNO, sp. nov.

(Figs. 3–4, 13)

Length: 5.05–5.55 mm (from apical margin of clypeus to apices of elytra).

Closely allied to *T. balli* S. UÉNO (1986 b, p. 15, figs. 1–3) of the prospecting adits at Tokorozawa of Koya, but different in somewhat smaller head and configuration of prothorax, which is a little narrower at the apex and has longer basal part, with the sides more strongly rounded in front. Evidently different from *T. balli* in the configuration of male genitalia.

Head as in *T. balli*, though the genae are a little less convex and the antennae reach the middle of elytra. Pronotum somewhat narrower at apex than in *T. balli*, widest at about two-thirds from base; sides more strongly rounded in front, more shallowly sinuate at about basal fourth, and then either less widely divergent towards hind angles or nearly parallel, with hind angles usually less sharp and less protrudent laterad; in one of the paratypes, two postangular setae present at the left side; basal area evidently longer than in *T. balli*; PW/HW 1.44–1.50 (M 1.47), PW/PL 1.13–1.16 (M 1.14), PW/PA 1.48–1.51 (M 1.49), PW/PB 1.33–1.41 (M 1.37), PB/PA 1.07–1.11 (M 1.09) [PA/PB 0.90–0.93 (M 0.92)]. Elytra as in *T. balli*, though more widely rounded at apices and a little more convex on dorsum; EW/PW 1.65–1.78 (M 1.74), EL/EW 1.43–1.51 (M 1.47). Legs somewhat



Figs. 3-6. Male genitalia of *Trechiana* (s. str.) spp. of the *echigonis* lineage; left lateral view (3, 5), and apical part of aedeagus, dorso-apical view (4, 6). — 3-4. *T. sinuatus* S. UÉNO, sp. nov., from Sasakawa-yama of Kogai. — 5-6. *T. ancorifer* S. UÉNO, sp. nov., from the Sanmori-tôgé.

slenderer than in *T. balli*.

Male genital organ fairly large and heavily sclerotized. Aedeagus about two-fifths as long as elytra, hardly arcuate, and widely membranous on dorsum, with elongate basal part gently curved ventrad, which is deeply emarginate at the sides of basal orifice and provided with a large hyaline sagittal aileron; apical lobe fairly long, gradually narrowed towards truncated apex in dorsal view; viewed laterally, apical lobe narrow, gradually tapered towards apex, distinctly curved ventrad behind apical orifice, sinuate, and ending in an upturned subtruncated extremity; ventral margin almost straight at middle in profile. Inner sac armed with a large elongate copulatory piece and two patches of sclerotized teeth; copulatory piece about two-sevenths as long as aedeagus, somewhat spatulate, rounded at the apex, and provided with a patch of thin spine-like scales at the left side of the apical part; left proximal teeth-patch small, consisting of rather a small number of heavily

sclerotized teeth, lying at the left side of the middle of copulatory piece, and continuing dorso-apically to a sheet of minute, poorly sclerotized scales; dorso-apical teeth-patch horizontal, broad and fairly short, lying just inside apical orifice. Styles slender, left style longer than the right, each bearing three setae at the apex, an extra minute seta present on the left style in one of the paratypes (cf. Fig. 3).

*Type series.* Holotype: ♂, allotype: ♀, paratypes: 4♂♂, 1♀, 18-IX-1994, K. ONDA leg. All deposited in the collection of the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo.

*Type locality.* Sasakawa-yama, 710 m in altitude, at Kogai of Inawashiro-machi in Fukushima Prefecture, Northeast Japan.

*Notes.* This and the following species fill in the wide blank in our knowledge about the distribution of the *echigonis* lineage of *Trechiamma*. The type locality of *T. sinuatus* is about 39 km distant to the south-southeast from that of *T. balli* and is about 21 km north by west of that of *T. ancorifer*, which is in turn about 55 km distant to the northwest from that of *T. sonuta*. It is true that there still remains a blank between the localities of *T. ancorifer* and *T. sonuta*, or at the western side of the Abukuma Hills, but a 55 km gap is only a half of the 110 km one between the type localities of *T. balli* and *T. sonuta*.

The occurrence of *T. sinuatus* near the northwestern foot of Mt. Tengunosumôtori-yama (1,327 m in height) is most unexpected, since the mountain is largely granitic and has been affected by the tephra spouted from the Bandai-san Volcanoes, which lie adjacent to the west. SONE and I paid a visit to the mountain late in the spring of 1994, and were disappointed at finding that the environmental condition was mostly unfavourable for the existence of upper hypogean fauna. ONDA's discovery has revised our former observation, showing that certain oases for subterranean beetles may continue to exist even in a seemingly unfavourable area.

*Trechiamma* (s. str.) *ancorifer* S. UENO, sp. nov.  
(Figs. 5-6, 14)

Length: 5.25-5.95 mm (from apical margin of clypeus to apices of elytra).

Very closely allied to the preceding species and distinguishable with confidence only by the remarkable difference in conformation of aedeagal apical lobe, which bears an adaxial anchor-like plate in this species instead of being sinuate dorso-ventrally and ending in a truncated reflexed apex.

Slightly larger on an average and usually a little darker in coloration than in *T. sinuatus*. Head as in *T. sinuatus*, but the antennae are somewhat longer, reaching apical four-ninths of elytra in ♂, the middle of elytra even in ♀. Pronotum somewhat variable in shape, though the sides are more deeply sinuate at a level between basal two-ninths and one-fourth and more widely divergent behind the sinuation; hind angles sharper and more distinctly protrudent laterad than in *T. sinuatus*; PW/HW 1.46-1.53 (M 1.49), PW/PL 1.14-1.21 (M 1.17), PW/PA 1.45-1.55 (M 1.51), PW/PB 1.34-1.41 (M 1.38), PB/PA 1.05-1.15 (M 1.10) [PA/PB 0.87-0.95 (M 0.92)]. Elytra as in *T. sinuatus*, though sometimes a little larger than in the latter; EW/PW 1.62-1.71 (M 1.67), EL/EW 1.44-1.51 (M 1.49); apical striole rarely joining stria 7 on one elytron. Legs as in *T. sinuatus*.

Male genital organ basically similar to that of *T. sinuatus*, but smaller and markedly different in conformation of aedeagal apical lobe. Aedeagus about one-third as long as elytra, elongate, depressed, and hardly arcuate, with elongate basal part and rather short apical lobe, both gently

curved ventrad; viewed dorsally, apical lobe narrowed towards fairly broad apex, which is sub-truncated and slightly tuberculate at the middle; viewed laterally, apical lobe gradually tapered towards pointed apex, which bears a small vertical semicircular plate forming an anchor; ventral margin hardly emarginate in profile. Inner armature as in *T. sinuatus*, but the copulatory piece is narrower, one-third as long as aedeagus, and provided with a row of sclerotized scales along the dorso-apical margin; teeth-patches as in *T. sinuatus*, though the left proximal teeth-patch is smaller. Styles narrow at the apical parts, left style a little longer than the right, each usually bearing three setae at the apex.

*Type series.* Holotype: ♂, allotype: ♀, 570 m alt., 15-V-1994, S. UÉNO & S. SONE leg. Paratypes: 2♂♂, same data as for the holotype; 3♂♂, 1♀ (incl. teneral 1♂, 1♀), same site, 30-VIII-1994, S. UÉNO & Y. NISHIKAWA leg.; 2♂♂, 2♀♀, 750 m alt., 15-V-1994, S. UÉNO & S. SONE leg. All deposited in the collection of the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo.

*Type locality.* Sanmori-tôgê, 570 m and 750 m in altitude at the eastern side, in Kohriyama-shi of Fukushima Prefecture, Northeast Japan.

*Further specimens examined.* 2♂♂, Umao-ga-taki, 460 m alt., Seishidô, Naganuma-machi, Fukushima Pref., 10-X-1993, S. UÉNO & S. SONE leg.; 2♂♂, 2♀♀, same locality, 31-VII-1994, S. UÉNO & S. SONE leg.; 1♀ (found dead), Seishidô, 560 m alt., Naganuma-machi, Fukushima Pref., 23-XI-1993, H. OHKAWA & K. ONDA leg.; 1♂, 1♀, Kimen-zan, 650 m alt., Seishidô, Naganuma-machi, Fukushima Pref., 23-XI-1993, H. OHKAWA & K. ONDA leg.; 1♂, 3♀♀, same locality but 590 m alt., 31-VIII-1994, S. UÉNO & Y. NISHIKAWA leg. All deposited in the collection of the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo.

*Notes.* The present species and *T. sinuatus* seem to be the vicariants isolated either by the topographical barrier formed by the Gohyaku-gawa Valley or by the existence of the area unfavourable for their lives. In any case, *T. ancorifer* is the only known representative of the *echigonis* lineage on the Nunobiki Hills.

The known habitats of *T. ancorifer* are separated into two groups, those on the Sanmori-tôgê and those in the Seishidô area, the latter of which are a little more than 10 km distant from the former in a southwestward direction. The specimens from the latter populations are slightly different from the type series. They are smaller on an average (4.90–5.55 mm in the length of body), and have the pronotal basal part less dilated posteriad. The parameral setae are mostly four in number instead of three. They are, however, identical with the former in the characteristic conformation of the aedeagal apical lobe, and can safely be regarded as belonging to *T. ancorifer*. The standard ratios in the Umao-ga-taki specimens are as follows: PW/HW 1.43–1.50 (M 1.46), PW/PL 1.16–1.21 (M 1.19), PW/PA 1.50–1.56 (M 1.53), PW/PB 1.38–1.45 (M 1.41), PB/PA 1.04–1.11 (M 1.08) [PA/PB 0.90–0.97 (M 0.92)], EW/PW 1.58–1.69 (M 1.64), EL/EW 1.48–1.51 (M 1.50). Those in the Kimen-zan specimens are: PW/HW 1.43–1.50 (M 1.47), PW/PL 1.14–1.22 (M 1.17), PW/PA 1.44–1.57 (M 1.51), PW/PB 1.38–1.44 (M 1.41), PB/PA 1.02–1.11 (M 1.07) [PA/PB 0.90–0.98 (M 0.94)], EW/PW 1.61–1.68 (M 1.65), EL/EW 1.46–1.56 (M 1.50).

At respective stations, the trechine beetle was dug out from the upper hypogean zone along narrow streams shaded by deciduous broadleaved trees. Its habitats were mostly met with at a depth of 50 cm or more, but the habitat at the 570 m site on the Sanmori-tôgê was exceptionally shallow, only 10–20 cm below the surface.

*Trechiamma* (s. str.) *oopterus* S. UÉNO, sp. nov.

(Figs. 7-9, 16)

Length: 4.95-5.50 mm (from apical margin of clypeus to apices of elytra).

Not unlike in general appearance *T. masatakai* S. UÉNO (1983, p. 12, figs. 6-7; 1985, p. 75, pl. 14, fig. 16) of the Zaô Mountains, but different in configuration of prothorax, which is obviously less contracted behind with hind angles less sharp and less protrudent laterad, and more convex elytra

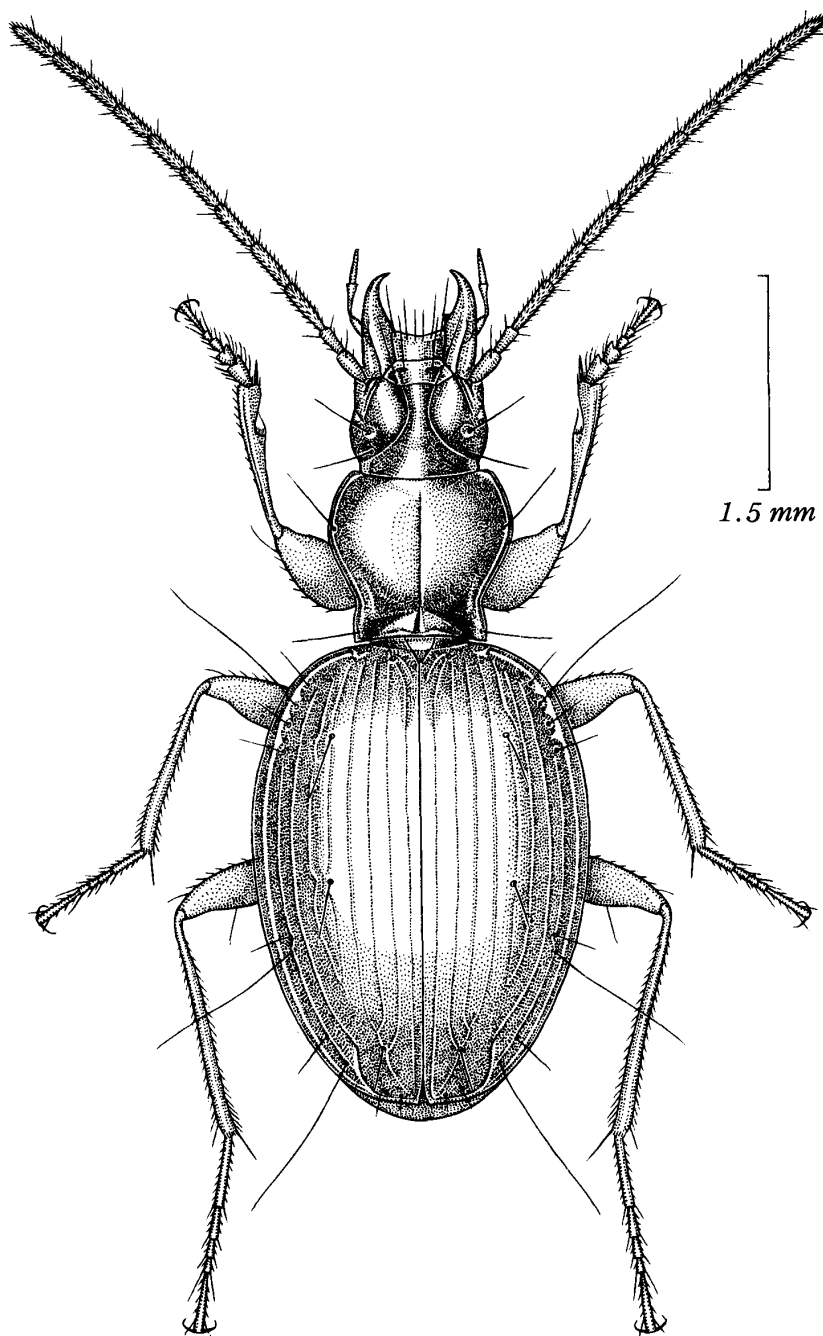


Fig. 7. *Trechiamma* (s. str.) *oopterus* S. UÉNO, sp. nov., ♂, from Togamimukai of Moniwa.



with less oblique prehumeral borders. Decisively different from *T. masatakai* in configuration of aedeagus, which indicates that the two species belong to different lineages.

Colour somewhat lighter than in *T. masatakai*, with yellowish brown appendages.

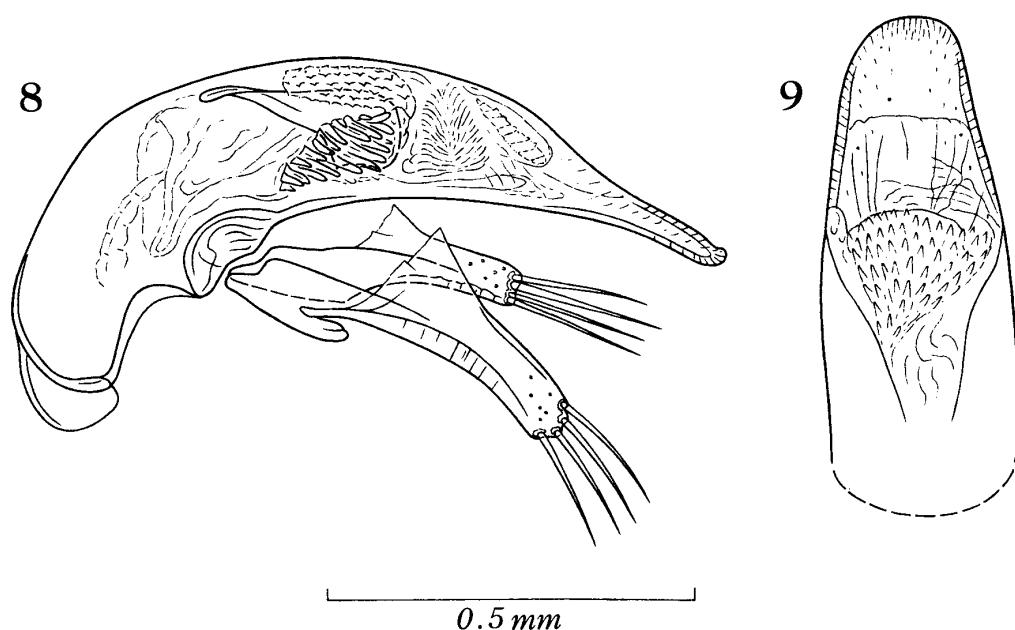
Head as in *T. masatakai*, though the genae are more convex; antennae somewhat thinner than in the latter, either reaching or extending slightly beyond the middle of elytra.

Pronotum subcordate, widest at about two-thirds from base, and a little more gradually narrowed towards base than towards apex, with basal part broader than in *T. masatakai*; sides more evenly and less strongly arcuate in front and less deeply sinuate at about basal two-ninths than in *T. masatakai*, less widely divergent before hind angles, which are less sharp and less protrudent laterad; apex always narrower than base, the latter nearly straight at middle and slightly oblique on each side; PW/HW 1.39–1.47 (M 1.44), PW/PL 1.09–1.17 (M 1.12), PW/PA 1.44–1.51 (M 1.48), PW/PB 1.34–1.40 (M 1.37), PB/PA 1.03–1.13 (M 1.08) [PA/PB 0.89–0.97 (M 0.93)]; other pronotal features as in *T. masatakai*.

Elytra broader in both basal and apical areas than in *T. masatakai*, widest at a level between basal two-fifths and four-ninths (usually at about two-fifths from base), more convex on dorsum especially at lateral parts, though gently depressed on the disc; EW/PW 1.72–1.83 (M 1.77), EL/EW 1.40–1.45 (M 1.43); shoulders widely rounded, with prehumeral borders slightly arcuate to the innermost and evidently less oblique than in *T. masatakai*; sides widely reflexed, moderately arcuate in basal halves, less so behind, and rather widely rounded at apices which form a small re-entrant angle at suture; striae as in *T. masatakai* though less clearly punctate, apical striole usually joining or almost joining stria 5, but sometimes joining stria 7 on one elytron and rarely on both the elytra; stria 5 with two setiferous dorsal pores at 1/6–2/9 (usually 1/5) and 3/10–4/7 (usually 1/2) from base, respectively.

Ventral surface and legs as in *T. masatakai*.

Male genital organ relatively small and rather lightly sclerotized. Aedeagus about three-tenths



Figs. 8–9. Male genitalia of *Trechiana* (s. str.) *oopterus* S. UENO, sp. nov., from Togamimukai of Moniwa; left lateral view (8), and apical part of aedeagus, dorso-apical view (9).

as long as elytra, short, depressed, and feebly arcuate, with large basal part and broad flattened apical lobe, the latter of which is very slightly curved ventrad; dorsal margin semicircularly rounded in lateral view; basal part strongly curved ventrad, deeply emarginate at the sides of basal orifice, and provided with a large hyaline sagittal aileron; viewed dorsally, apical lobe very broad, nearly symmetrical, and very gradually narrowed towards apex, which is very widely rounded; viewed laterally, apical lobe long and narrow, nearly parallel-sided to near the blunt tip, which is slightly tuberculate dorsad; ventral margin slightly emarginate in profile. Inner sac armed with a copulatory piece at the right side of the middle and two patches of sclerotized teeth; copulatory piece about two-sevenths as long as aedeagus, very narrow and twisted at the proximal part, dilated apically, and curved ventrad at the distal part; left proximal teeth-patch situated at the left side of the apical part of copulatory piece, consisting of large, heavily sclerotized teeth in ventral half but of small, poorly sclerotized scales in recurrent dorsal part; dorso-apical teeth-patch smaller than the left proximal, horizontal, and lying just inside apical orifice; a compact patch of thin spine-like scales present at the left side behind the heavily sclerotized teeth-patch. Styles large and broad, left style much larger than the right, each bearing four setae at the apex.

*Type series.* Holotype: ♂, allotype: ♀, 30-VIII-1994, S. UÉNO leg. Paratypes: 4♂♂, 1♀, same date, S. UÉNO & Y. NISHIKAWA leg. All deposited in the collection of the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo.

*Type locality.* Togamimukai, 290 m in altitude, at Moniwa of Iizaka-machi in Fukushima-shi, Fukushima Prefecture, Northeast Japan.

*Notes.* It was most unexpected that a species of the *echigonis* lineage in a strict sense did occur on the southern continuation of the Zaô Mountains. It is true that *T. oopterus* resembles *T. masatakai* in general appearance, but the male genitalia, especially the broad apical lobe of the aedeagus, clearly show its closer affinity to *T. accipitrus* occurring on the Shirataka Hills to the west of the Zaôs. The distance from Togamimukai, the type locality of *T. oopterus*, to the Yoko-kawa Valley, the southern known locality of *T. masatakai*, is 17.5 km in a north-northeastward direction, and to Sasagodaira on Ohtaka-yama Hill, the southern known locality of *T. accipitrus*, is 29.5 km in a northwestward direction. As was already pointed out (cf. UÉNO, 1992 b, p. 32), the most archaic lineage of the *echigonis* subgroup consists of the species of the *accipitrus-balli-sonuta* type. *Trechiana oopterus* also belongs to this lineage, though rather peculiar in its facies. As will be shown later, this is the only assemblage of species in the *echigonis* subgroup that has a wide range of distribution. All the other lineages are derivative and more localized, as is the case of *T. cordicollis*.

The type locality of this interesting species lies in the Surikami-gawa drainage at the eastern side of the Ôu Mountain Range, or more precisely, at the right side of a narrow branch stream of the Karasu-gawa, a tributary of the Surikami-gawa River. All the specimens known were dug out from a loose colluvium shaded by deciduous broadleaved trees just above the water edge. They were unusually quick on their legs, too quick to be easily caught with an aspirator.

#### Record of New Localities

As was mentioned in the introduction of this paper, the western side of the Nunobiki Hills is narrowly occupied by a member of the *insperatus* subgroup of *Trechiana*. Of the three localities hitherto found, the southernmost one, Futamata-yama, was already recorded in a previous paper of mine (UÉNO, 1993, p. 2). On the other hand, another locality of a trechine beetle belonging to the

same lineage was recently discovered at the northeastern part of the Minamiaizu Hills to the west of the Nunobikis.

After a close comparative study of the specimens from these four populations, I have come to the conclusion that all of them should be regarded as belonging to a single species, *Trechiana insperatus* S. UÉNO, though minor differences are observed in both the external and genitalic morphology between different populations. Their collecting data are as recorded below.

***Trechiana* (s. str.) *insperatus* S. UÉNO, 1970**

*Trechiana* (s. str.) *insperatus* S. UÉNO, 1970, Bull. natn. Sci. Mus., Tokyo, 13, p. 65, figs. 1–2; type locality:

Inkyogura on the Nasu Volcanoes; 1993, J. speleol. Soc. Japan, 18, p. 2, figs. 2–4.

For other references, see UÉNO (1993, p. 2).

**Additional specimens examined.** 8♂♂, 3♀♀, Suganuma, 370 m alt., Takagawa, Ohto-machi, Aizuwakamatsu-shi, Fukushima Pref., 17–VIII–1994, K. ONDA leg.; 2♂♂, 3♀♀, Ohdakamori-yama, 480 m alt. on SW slope, Yugawa, Aizuwakamatsu-shi, Fukushima Pref., 31–VII–1994, S. UÉNO & S. SONE leg.; 6♂♂, Shôbu-zawa, 490 m alt., Yuinô, Higashiomata, Aizutakada-machi, Fukushima Pref., 28–VIII–1994, K. ONDA leg. All deposited in the collection of the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo.

**Notes.** Of the three localities recorded above, Suganuma and Ohdakamori-yama lie on the Nunobiki Hills and the Shôbu-zawa lies on the Minamiaizu Hills. They are not far apart from one another: Suganuma, which lies at the northern foot of Ohto-yama 15.7 km north by west of Futamata-yama, is only 6.5 km distant to the south-southwest from Ohdakamori-yama and 10.3 km distant to the east from the Shôbu-zawa. However, they belong to three different tributaries of the Oh-kawa, one of the upper courses of the Agano-gawa River. Topographically, Suganuma and Ohdakamori-yama are closer to each other than to the Shôbu-zawa, since they are located just at both sides of Mt. Takatsuburi-yama (933 m in height), one of the northwestern heads of the Nunobiki Hills. The Shôbu-zawa is isolated from the others by the deep valley of the Oh-kawa River, though it does not seem to have formed an effective barrier against the dispersal of *T. insperatus*.

**General Remarks**

The subgroup of *Trechiana echigonis* was first recognized by myself (UÉNO, 1981, p. 129) as two subgroups of the *habei* group, which were later united due to the discoveries of intermediate species (UÉNO, 1983, p. 7). At the same time (UÉNO, 1981, p. 129), *T. insperatus* was incorporated into the *habei* group, though considered to form an isolated subgroup of its own. The two subgroups are readily discriminated by the presence or absence of the elytral dorsal pore of the internal series and the difference in general configuration of the male genitalia, and cannot be considered directly related to each other. In any case, they are the only assemblages of anophthalmic *Trechiana* that occur in northeastern Honshu. Their derivation is not apparent, since their distributional ranges are widely separated by the Kwantô Plain from those of the other subgroups of the *habei* group. Of these, the *tamaensis* subgroup occupies an area (mainly the southwestern part of Kwantô District) geographically nearest to the distributional ranges of the northeastern subgroups, and the occurrence of *T. tanzawanus* S. UÉNO et SONE (1994, p. 210, figs. 5–7), which shares the loss of the dorsal pore on the third elytral stria with the members of the *echigonis* subgroup, may suggest a remote relationship between the two subgroups.

**The *echigonis* subgroup.** The *echigonis* subgroup comprises thirteen known species distributed in an area about 205 km from north to south and nearly 130 km from east to west (Fig. 23, Nos. 1–22). They are roughly classified into four lineages, mainly by configuration of male genitalia. The largest of the four is the *echigonis* lineage in a strict sense principally characterized by the broad apical lobe of the aedeagus more or less widely rounded at the apex (Figs. 10–17). Eight known species belong to this lineage, that is, *T. echigonis* S. UÉNO (1972, p. 43, figs. 1–3), *T. planipennis* sp. nov., *T. accipitrinis* S. UÉNO (1983, p. 8, figs. 2–5), *T. balli* S. UÉNO (1986 b, p. 15, figs. 1–3), *T. sinuatus* sp. nov., *T. ancorifer* sp. nov., *T. sonuta* S. UÉNO (1992 b, p. 28, figs. 4–6), and *T. oopterus* sp. nov. Of these, *T. echigonis* and *T. oopterus* are relatively derivative, the former in having the aedeagal apical lobe moderately tapered towards the apex which is rather narrowly rounded (Fig. 17), and the latter in having the prothorax considerably modified in configuration.

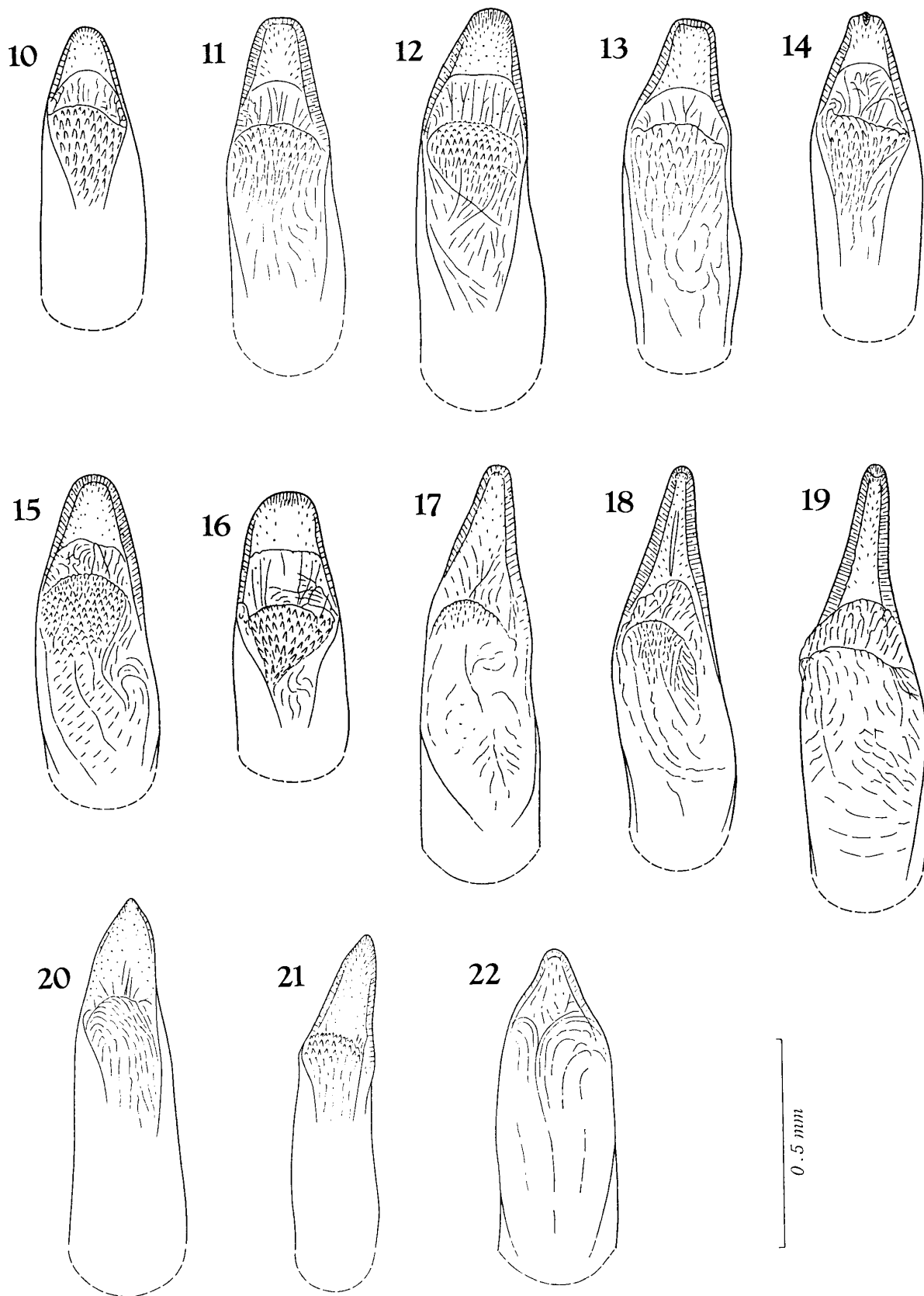
The remaining six species of the *echigonis* lineage are closely related to one another, and can be discriminated with confidence by aedeagal differences alone. They are distributed along the southern periphery of the distributional range of the subgroup, from the Shirataka Hills in the north to the central part of the Abukuma Hills in the south for a distance of more than 130 km (Fig. 23, Nos. 2–13). This pattern of their distribution and the unmodified apical lobes of their aedeagi seem to suggest that these species represent the oldest descendants of the ancestral type of the *echigonis* subgroup. The two other species of the same lineage mentioned above must have been derived from the same ancestor, but have become differentiated to some more extent by dispersing northwestwards along the Ara-kawa Valley and northwards along the Ôu Mountain Range.

Closest to the *echigonis* lineage is the *kusakarii* lineage consisting of two known species, *T. kusakarii* S. UÉNO (1986 a, p. 179, figs. 1–3) and *T. uncatatus* S. UÉNO (1986 a, p. 182, figs. 4–5) occurring side by side in the centre of the distributional range of the former lineage (Fig. 23, Nos. 15–18). It is characterized by the slender aedeagal apical lobe with narrowly rounded apex (Figs. 18–19) and the reduction of the aedeagal lateral walls, but the former peculiarity can be regarded as a more specialized form of the tapered apical lobe possessed by *T. echigonis*. It is therefore possible to regard the two species as representing the extreme derivatives of the *echigonis* lineage. It is, however, difficult to explain how such a differentiation could have taken place at the southwestern side of the Yonezawa Basin almost sympatrically with *T. balli*.

Next to be considered is the *masatakai* lineage, which consists of two known species, *T. masatakai* S. UÉNO (1983, p. 12, figs. 6–7) of the Zaô Mountains, and *T. umbraticus* S. UÉNO (1983, p. 15, figs. 8–9) of the Hinotodaké Hills (Fig. 23, Nos. 19–21). It is readily distinguished from the other lineages by the elongate subtriangular apical lobe of aedeagus (Figs. 20–21). It is also recognized on the cordiform prothorax, though similarly shaped prothorax is found in *T. oopterus* of the *echigonis* lineage and *T. cordicollis* to be discussed below. Here again, the aedeagal peculiarity can be regarded as a high modification of the broad ancestral type, and if so, ancestors of this lineage must

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Figs. 10–22. Dorso-apical view of aedeagal apical lobes in the *echigonis* subgroup of *Trechiamia*, showing modification according to different lineages. — 10–17. *Trechiamia echigonis* lineage (10, *T. planipennis* S. UÉNO; 11, *T. accipitrinis* S. UÉNO; 12, *T. balli* S. UÉNO; 13, *T. sinuatus* S. UÉNO; 14, *T. ancorifer* S. UÉNO; 15, *T. sonuta* S. UÉNO; 16, *T. oopterus* S. UÉNO; 17, *T. echigonis* S. UÉNO). — 18–19. *Trechiamia kusakarii* lineage (18, *T. kusakarii* S. UÉNO; 19, *T. uncatatus* S. UÉNO). — 20–21. *Trechiamia masatakai* lineage (20, *T. masatakai* S. UÉNO; 21, *T. umbraticus* S. UÉNO). — 22. *Trechiamia cordicollis* lineage (*T. cordicollis* S. UÉNO).



have dispersed from south to north along the western side of the Ôu Mountain Range. The northward dispersal must have been accelerated by the floods of the Mogami-gawa River, which resulted in making discontinuous occurrence of the members of this lineage. The localities of the two known species are about 95 km apart, and though we have endeavoured to find other species of the same lineage in the intervening areas along the course of the large river, we have been unable to find any of them. This probably means that the members of the *masataikai* lineage occur sporadically and can be met only by chance.

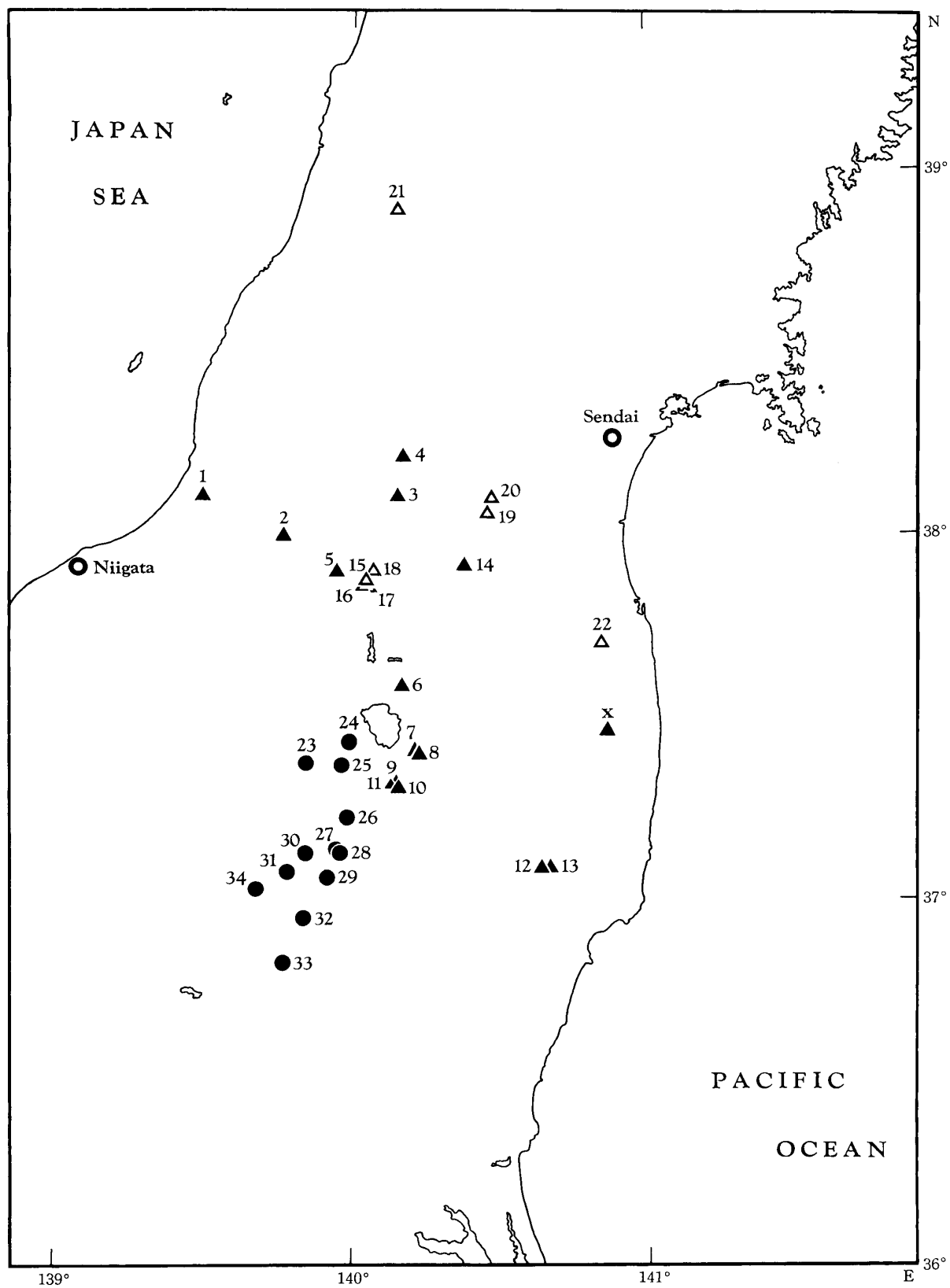
The last lineage of the *echigonis* subgroup is recognized on a single isolated species, *T. cordicollis* S. UÉNO (1974, p. 106, figs. 2–5), so far known from only a limestone cave lying at the northeastern part of the Abukuma Hills (Fig. 23, No. 22). It resembles the members of the preceding lineage in general appearance, but is unique in the conformation of its aedeagus, which is short and robust, bearing a short subtriangular apical lobe (Fig. 22), a very large copulatory piece, and peculiarly formed teeth-patches. At the moment, it is difficult to account for the derivation of this species, and all our efforts to find out a second species of the same lineage, which may give us a clue for clarifying the true affinity of the species in question, have not been repaid so far.

It has been known that the Abukuma Hills harbour certain relict species of insects and other small animals. A beautiful example of this is an oculate trechine beetle, *Trechiana absuma* S. UÉNO (1992 a, p. 146, figs. 1–3), which survives only in a sink at the central part of the hill range. *Trechiana cordicollis* may be another example of such a relict species, which has been isolated long enough to develop peculiarities of its own.

**The *insperatus* subgroup.** The anophthalmic trechines belonging to this subgroup were carefully studied in a previous paper of mine (UÉNO, 1993), and nothing taxonomically new can be added to that account at the present moment. What was unknown then is that the distributional range of *T. insperatus* extends northwards along the Oh-kawa Valley to near the Aizu Basin (Fig. 23, Nos. 23–25). Thus, the distributional range of the *insperatus* subgroup almost meets that of the *echigonis* subgroup on the Nunobiki Hills, though actually they are allopatric. At the northern part of the hill range, the former subgroup occupies the western side of Lake Inawashiro-ko, whereas the latter

Fig. 23. Map showing the known localities of anophthalmic *Trechiana* belonging to the *echigonis* and the *insperatus* subgroups; black triangles: species of the *echigonis* lineage; open triangles: species of derivative lineages of the *echigonis* subgroup; black circles: species of the *insperatus* subgroup. — 1, *T. echigonis* S. UÉNO (Harukiyama); 2, *T. planipennis* S. UÉNO (Gokuraku-tôgê); 3–4, *T. accipitris* S. UÉNO (3, Sasagodaira; 4, Kotaki-goê); 5, *T. balli* S. UÉNO (prospecting adits at Tokoro-zawa of Koya); 6, *T. sinuatus* S. UÉNO (Sasakawa-yama of Kogai); 7–11, *T. ancorifer* S. UÉNO (7, Sanmori-tôgê (750 m site); 8, same pass (570 m site); 9, Seishidô; 10, Umao-ga-taki; 11, Kimen-zan); 12–13, *T. sonuta* S. UÉNO (12, Kumakura; 13, Kubomé); 14, *T. oopterus* S. UÉNO (Togamimukai); 15–16, *T. kusakarii* S. UÉNO (15, conduit of the Omono-gawa Dam at Yamanashizawa; 16, Shibakura); 17–18, *T. uncatas* S. UÉNO (17, Itoguro; 18, Atago-yama); 19–20, *T. masataikai* S. UÉNO (19, Yoko-kawa Valley; 20, Hyôtan-numa on Mt. Sugi-ga-miné); 21, *T. umbraticus* S. UÉNO (Ikuji-zawa); 22, *T. cordicollis* S. UÉNO (Oh-ana Cave at Tateishi); 23–28, *T. insperatus* S. UÉNO (23, Shôbu-zawa at Yuinô; 24, Ohdakamori-yama; 25, Suganuma; 26, Futamata-yama; 27, Oh-tôgê; 28, Inkyogura); 29–31, *T. ondai* S. UÉNO (29, Shiozawa; 30, Kurotakimata-yama; 31, Ojika-zawa); 32–34, *T. ohkawai* S. UÉNO (32, Shionoyu; 33, Nishiarakawa Valley at Higashigoya; 34, Shibakusa-yama).

N. B. The black triangle marked with the letter x (Ganjiki-dô Cave) is the locality of a new species of the *echigonis* lineage discovered after the editing of this number of the Memoirs was completed.



occupies the eastern. At the central and the southern parts, however, there are no topographical or geological gaps between the areas occupied by respective subgroups. Besides, Kimen-zan (Fig. 23, No. 11), which is the southwesternmost known locality of *T. ancorifer*, is almost equally distant (only about 16 km) from Suganuma (Fig. 23, No. 25) and from Futamata-yama (Fig. 23, No. 26), both of which harbour *T. insperatus*.

As was already elucidated, *T. ancorifer* belongs to the oldest species-complex of the *echigonis* subgroup, which is widely distributed in the southern part of the subgroup range. Colonization of the Nunobiki Hills by its ancestor must have taken place at a time much older than the northward dispersal of *T. insperatus*, since it has become speciated into an endemic form which even shows slight geographical differentiation. The *insperatus* subgroup, on the other hand, is mainly distributed in the hilly areas to the north of the Kwantô Plain (Fig. 23, Nos. 27–34), where it has become differentiated into three, closely related species. The northernmost one of the three, *T. insperatus*, dispersed further north into the Oh-kawa Valley, and most probably with the aid of floods, spread its habitats to near the Aizu Basin. This hypothesis seems to account for the narrowly extended distributional range of *T. insperatus* on both sides of the Oh-kawa River and for the mal-differentiation of the species over an area more than 30 km long.

It seems worth noting at this place that no anophthalmic *Trechiana* has so far been known from the Yamizo Mountains stretching from north to south parallel to the southern part of the Abukuma Hills. Contrary to the case of the Nunobiki Hills, three species of *Kurasawatrechus* have been reported from the endogean and the upper hypogean zones of this mountain range (cf. UENO, 1988, 1990 a). At least one of the two subgroups of *Trechiana* could have reached the Yamizos, especially their northern part. Our present knowledge about the trechine fauna of the surrounding areas of the Nunobiki Hills is still insufficient for the understanding of the whole picture. It is to be hoped that future investigations will bring about satisfactory results that fill in the remaining blanks and enable us to analyse the distribution of *Trechiana* on a sounder basis.

## 要 約

猪苗代湖と那須火山とのあいだに位置する布引山地の昆虫相は、これまであまり詳しく調べられたことがなかった。しかし、チビゴミムシ類など地上性ないし地下性の甲虫については、阿武隈山地と山形県南部などとの関連を知るうえで、ひじょうに重要な地位を占めることがわかったので、周辺地域を含めて綿密な調査を実施し、興味深い成果を納めることができた。

東北地方南部から関東地方北部にかけての地域には、複眼のなくなったナガチビゴミムシ属の甲虫類が2系統、分布しているが、それぞれから1種ずつの分布域が、布引山地でほとんど接触する。阿武隈山地を含めて、布引山地より北側に分布する種類は、ハベメクラチビゴミムシ群のエチゴメクラチビゴミムシ亜群に属し、現在13種が知られている。南側に分布するものはナスメクラチビゴミムシ亜群に属し、これまでに3種が知られているが、そのうちの1種の分布域が、布引山地の西側の地域を、大川沿いに会津盆地の近くまで延びている。この論文では、両亜群の分布および分化のようすを概観し、エチゴメクラチビゴミムシ亜群の4新種を記載した。新種に与える新和名は、下記のとおりである。

1. *Trechiana planipennis* S. UENO    オグニメクラチビゴミムシ
2. *Trechiana sinuatus* S. UENO    イナワシロメクラチビゴミムシ
3. *Trechiana ancorifer* S. UENO    ヌノビキメクラチビゴミムシ
4. *Trechiana oopterus* S. UENO    スリカミメクラチビゴミムシ



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